

# ***Paguristione uniropodus*, a new genus and a new species of Pseudioninae infesting hermit crabs from China (Crustacea, Isopoda, Bopyridae)**

Jianmei An<sup>1</sup>, Qiuping Zhao<sup>1</sup>, John C. Markham<sup>2</sup>

**1** School of Life Science, Shanxi Normal University, Linfen, 041004, P.R. China **2** Arch Cape Marine Laboratory, Arch Cape, Oregon 97102-0133, U.S.A.

Corresponding author: Jianmei An (anjianmei@hotmail.com)

---

Academic editor: S. Brix | Received 21 August 2015 | Accepted 5 February 2016 | Published 5 April 2016

---

<http://zoobank.org/BBD6C995-9995-4867-B71B-726AF196EE05>

---

**Citation:** An J, Zhao Q, Markham JC (2016) *Paguristione uniropodus*, a new genus and a new species of Pseudioninae infesting hermit crabs from China (Crustacea, Isopoda, Bopyridae). ZooKeys 577: 43–53. doi: 10.3897/zookeys.577.6295

---

## **Abstract**

*Paguristione uniropodus* gen. n., sp. n. infests *Paguristes* sp. in the East China Sea. *Paguristione* gen. n. differs from the closely related genera *Pseudione* and *Pagurion* by its females having indistinct lateral plates on the last two pleomeres and its male with a long tapering pleon of six pleomeres, lacking both pleopoda and uropoda.

## **Keywords**

*Paguristes*, East China Sea

## **Introduction**

Bopyrid isopods infesting hermit crabs belong to the subfamilies Pseudioninae (branchial parasites) and Athelginae (dorsoabdominal parasites). An, Markham and Yu (2010), An, Williams and Yu (2011) and An, Li and Markham (2013) have reported a total of eight bopyrid species infesting hermit crabs in the South China Sea. Markham (1992) recorded six species of bopyrids infesting hermit crabs in Hong Kong. Boyko (2004)

reported one such species from Taiwan. In Chinese waters as a whole, An (2006) reported ten species of bopyrids infesting hermit crabs. Currently, throughout Asia, 36 species are recorded infesting 48 hermit crabs from Asia (Table 1). Worldwide, McDermott, Williams and Boyko (2010) catalog 83 species of bopyrids infesting hermit crabs, of which 41 species in ten genera are branchial parasites. As hosts worldwide, 11 species of *Paguristes* are known to bear bopyrids (Table 2); their parasites, all branchially infesting members of the subfamily Pseudioninae, are in the genera *Asymmetrione*, *Pseudione*, *Parapagurion* and now the new genus *Paguristione*.

Specimens used in this study were collected from the East China Sea in 1958, and one of the authors (An 2006) examined the parasites and reported *Parapagurion glabra* sp. n. infesting *Paguristes* sp. in her doctoral dissertation (not a published work in the sense of the ICBN). Further examination shows that they represent a new species in a new genus. The name *Parapagurion glabra* is here entered into its synonymy.

## Material and methods

Materials for this study originated from Chinese Comprehensive Oceanographic Survey. All materials examined have been deposited in the Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China (IOCAS). Specimens were viewed and drawn using a Zeiss Stemi SV Apo microscope.

## Taxonomy

### Family BOPYRIDAE Rafinesque-Schmaltz, 1815

#### Subfamily Pseudioninae R. Codreanu, 1967

#### *Paguristione* gen. n.

<http://zoobank.org/1076C4FA-D580-45AC-A918-B28C2D1FC396>

**Diagnosis.** Female. All body segments distinct, almost symmetry. Rudimentary coxal plates present in first four segments. Marsupium complete. Oostegite 1 with simple tubercles on internal ridge. Palp of maxilliped with long setae. All pleomeres distinct. First three pleomeres with lateral plates and biramous pleopoda. Fourth and fifth pleomeres with biramous pleopoda, but lateral plates without lateral plates. Sixth pleomere without lateral plates, uropoda uniramous. Male. All segments distinct. First and last pereomeres respectively much broader than adjacent head and first pleomere. Pereopods of first pair smaller than those of following 3 pairs. Pleon elongate, of 6 distinct pleomeres. No pleopoda or uropoda.

**Etymology.** Combination of the genus name of its host, *Paguristes* and bopyrid genus name *Ione*. Gender feminine.

**Type species.** *Paguristione uniuropodus* sp. n., herein designated.

**Table 1.** Bopyrid isopods infesting hermit crabs in Asian waters.

Subfamily Pseudioninae	Hosts	Localities	References
<i>Asymmetrione asymmetrica</i> (Shiino, 1933)	<i>Clibanarius bimaculatus</i> (De Haan, 1849) <i>Clibanarius merguiensis</i> de Man, 1888	Japan Thailand	Shiino 1933 Markham 1985a; Brunnenmeister 1980
<i>Asymmetrione salyaevi</i> Williams & Schuerlein, 2005	<i>Diogenes avarus</i> Heller, 1865	Singapore	Williams and Schuerlein 2005
<i>Bopyrissa dawydoffi</i> (Codreanu & Codreanu, 1963)	<i>Clibanarius merguiensis</i> de Man, 1888	Vietnam	Codreanu and Codreanu 1963
<i>Bopyrissa liberorum</i> Markham, 1985	<i>Clibanarius merguiensis</i> de Man, 1888	Thailand	Markham 1985a
<i>Bopyrissa pyriforma</i> (Shiino, 1958)	<i>Clibanarius bimaculatus</i> (De Haan, 1849) <i>Diogenes edwardsii</i> (De Haan, 1849)	Hong Kong Japan	Markham 1982 Shiino 1958
<i>Bopyrophryxus branchiabdominalis</i> Codreanu, 1965	<i>Oncopagurus monstruosus</i> (Alcock, 1894) <i>Paragiopagurus acutus</i> (de Saint Laurent, 1972)	Indonesia Philippines	Bourdon and Boyko 2005 Bourdon and Boyko 2005
<i>Pagurion arrosor</i> An, Li & Markham, 2013	unidentified pagurid	Indonesia	Bourdon and Boyko 2005
<i>Pagurion tuberculata</i> Shiino, 1933	<i>Dardanus arrosor</i> (Herbst, 1796)	China	An, Li and Markham 2013
<i>Pagurocryptella holthuisi</i> Boyko & Williams, 2010	<i>Dardanus scutellatus</i> (H. Milne Edwards, 1848) <i>Dardanus aspersus</i> (Berthold, 1846)	Japan China	Shiino 1933 An, Li and Markham 2013
<i>Parapagurion calcincola</i> Shiino, 1933	<i>Solitariopagurus tuerkayi</i> McLaughlin, 1997 <i>Calcarus elegans</i> (H. Milne Edwards, 1836) <i>Calcarus limapropodus</i> Morgan & Forest, 1991 <i>Paguristes monoporus</i> Morgan, 1987 <i>Paguristes</i> sp. <i>Pagurus</i> aff. <i>helleyi</i> or <i>kulkarnii</i>	Japan Japan Japan Indonesia Thailand	Boyko and Williams 2010 Shiino 1933 Shiino 1933 Haig and Ball 1988 Markham 1985a
<i>Panapsidionone data</i> Shiino, 1958	<i>Pagurus middendorffii</i> Brandt, 1851	Japan	Shiino 1958
<i>Propseudionone rhombicosoma</i> Shiino, 1933	<i>Calcarus laevimanus</i> (Randall, 1840)	Japan	Shiino 1933
<i>Pseudionone calcinii</i> Shiino, 1958	<i>Calcarus morganii</i> Rahayu & Forest, 1999	Japan	Shiino 1933
<i>Pseudionone clibanaricola</i> Shiino, 1933	<i>Calcarus latens</i> (Randall, 1840)	Japan	Shiino 1958
<i>Pseudionone hyndmanni</i> (Bate & Westwood, 1868)	<i>Clibanarius bimaculatus</i> (De Haan, 1849) <i>Pagurus</i> sp.	Japan	Shiino 1933
<i>Pseudionone intermedia</i> Nierstrasz & Brender à Brandis, 1932	<i>Lophopagurus (Australeremus) triserratus</i> (Ortmann, 1892)	Japan	Shiino 1936
<i>Pseudionone kensleyi</i> Williams & Schuerlein, 2005	<i>Pagurus</i> sp.? <i>Clibanarius infraspinosus</i> Hilgendorf, 1869	Singapore	Nierstrasz and Brender à Brandis 1932 Williams and Schuerlein 2005

	Hosts	Localities	References
<b>Boxyrids</b>			
<i>Pseudionella nobili</i> Nierstrasz & Brender à Brandis, 1923	<i>Trizochelus spinosus</i> (Henderson, 1888)	Indonesia	Nierstrasz and Brender à Brandis 1923
<i>Pseudionella attenuata</i> Shiino, 1949	<i>Pagurus</i> sp.	Japan	Shiino 1949
<i>Pseudionella spiropaguri</i> An, Li & Markham, 2013	<i>Spiropagurus profundorum</i> Alcock, 1905	China	An, Li and Markham 2013
	<i>Spiropagurus spiriger</i> (De Haan, 1849)	China	An, Li and Markham 2013
<i>Parasymmetrione tuberculineata</i> An, Markham & Yu, 2010	<i>Clibanarius corallinus</i> (H. Milne-Edwards, 1848)	South China Sea	An, Markham and Yu 2010
<i>Asymmetrione globifera</i> An, Markham & Yu, 2010	<i>Dardanus bessii</i> (Miers, 1884)	Beibu Gulf	An, Markham and Yu 2010
	<i>Spiropagurus</i> sp.	South China Sea	An, Markham and Yu 2010
<b>Subfamily Athelginae</b>			
<i>Allathelges pakistanensis</i> Kazmi & Markham, 1999	<i>Paguristes perspicax</i> Nobili, 1906	Pakistan	Kazmi and Markham 1999
<i>Athelges akkanoshimensis</i> var. <i>teniibranchiatus</i> Shiino, 1936	<i>Lophopagurus (Australeremus) triserratus</i> (Ortmann, 1892)	Japan	Shiino 1936
	<i>Pagurus constans</i> (Stimpson, 1858)	Japan	Shiino 1958
	<i>Pagurus lanuginosus</i> De Haan, 1849	Japan	Shiino 1958
	<i>Pagurus middendorffii</i> Brandt, 1851	Japan	Shiino 1958
<i>Athelges</i> sp.	<i>Trizopagurus strigatus</i> (Herbst, 1804)	Indonesia	Haig and Ball 1988

**Table 2.** Known bopyrids infesting *Paguristes* species with localities and references.

Bopyrids	Host	Type locality	References
<i>Asymmetrione aequalis</i> Pardo, Boyko & Mantelatto, 2009	<i>P. tomentosus</i> H. Milne Edwards, 1848	Peru	Pardo et al. 2009
<i>Asymmetrione desultor</i> Markham, 1975	<i>P. tortugae</i> Schmitt, 1933	Brazil	Bourdon 1979
<i>Asymmetrione foresti</i> (Bourdon, 1968)	<i>P. eremita</i> (Linnaeus, 1767)	Mediterranean	Bourdon 1968
<i>Parapagurion calcincola</i> Shino, 1933	<i>P. monoporus</i> Morgan, 1987	Indonesia	Haig and Ball 1988
<i>Parapagurion imbricata</i> Markham, 1978	<i>P. sp.</i>	Thailand	Markham 1985a
<i>Pseudione biacuta</i> Bourdon, 1979	<i>P. tortugae</i> Schmitt, 1933	Cuba	Markham 1978
<i>Pseudione quasimodo</i> Boyko & Williams, 2004	<i>P. robustus</i> Forest & de Saint Laurent, 1967	Uruguay	Bourdon 1979
<i>Athelges pelagoae</i> Babić, 1912	<i>P. grayi</i> Benedict, 1901	Bahamas	Boyko and Williams 2004
<i>Parathelges piriformis</i> Markham, 1972	<i>P. invisusculus</i> McLaughlin & Provenzano, 1974	Bahamas	Boyko and Williams 2004
<i>Parathelges whiteleggei</i> Nierstrasz & Brender à Brandis, 1931	<i>P. anahuachis</i> Glassell, 1938	Gulf of California	Brusca 1980
<i>Pseudostegia otagoensis</i> Page, 1985	<i>P. perspicax</i> Nobili, 1906	Pakistan	Kazmi and Markham 1999
<i>Allathelges pakistanensis</i> Kazmi & Markham, 1999	<i>P. eremita</i> (Linnaeus, 1767)	Adriatic	Babić 1912
<i>Parathelges oxyophthalmus</i> Holthuis, 1959	<i>P. perspicax</i> Nobili, 1906	Colombia	Markham 1978
<i>Pseudostegia barbatus</i> (Heller, 1862)	<i>P. monoporus</i> Morgan, 1987	Indonesia	Haig and Ball 1988
		New Zealand	Page 1985

***Paguristione uniupodus* sp. n.**

<http://zoobank.org/E7EECB56-131C-4682-825B-1CBE50B12DCE>

Fig. 1

*Parapagurion grabla* An, 2006 (unpublished thesis): 30–31, fig. 8 (invalid name).

**Material examined.** Infesting *Paguristes* sp. Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China (IOCAS). Chinese Comprehensive Oceanographic Survey, East China Sea, Station 4081, 28°00'N, 128°30'E, 74m, 5 April 1958, Yulin Liao, coll. Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China (IOCAS). 1♀ holotype, CIEA408101; 1♂, allotype, CIEA408102.

**Description of holotype female.** Length 5.20 mm, maximal width 3.41 mm across third pereomere, head length 1.0 mm, head width 1.31 mm. Body distorted about 16° (Fig. 1A).

Head subelliptical, fully embedded in pereomere 1, with short frontal lamina completely across anterior margin. Eyes absent (Fig. 1A). Antennae with two articles and three articles respectively (Fig. 1C). Maxilliped (Fig. 1D, E) with prominent round articulating palp, that fringed on medial margin by sparse setae. Plectron short and blunt. Barbula (Fig. 1F) with 2 large sharp falcate projections on each side, medially unornamented.

Pereon broadest across third pereomere. First 3 pereomeres with coxal plates. Brood pouch completely enclosed by oostegites. First oostegite (Fig. 1G, H) with deep groove separating 2 articles externally; internal ridge bearing 4–7 simple projections; posterolateral point extending laterally. Pereopods rudimentary, not extending beyond margins of brood pouch, visible only ventrally; all pereopods with all articles distinct, of nearly same size and structure (Fig. 1I).

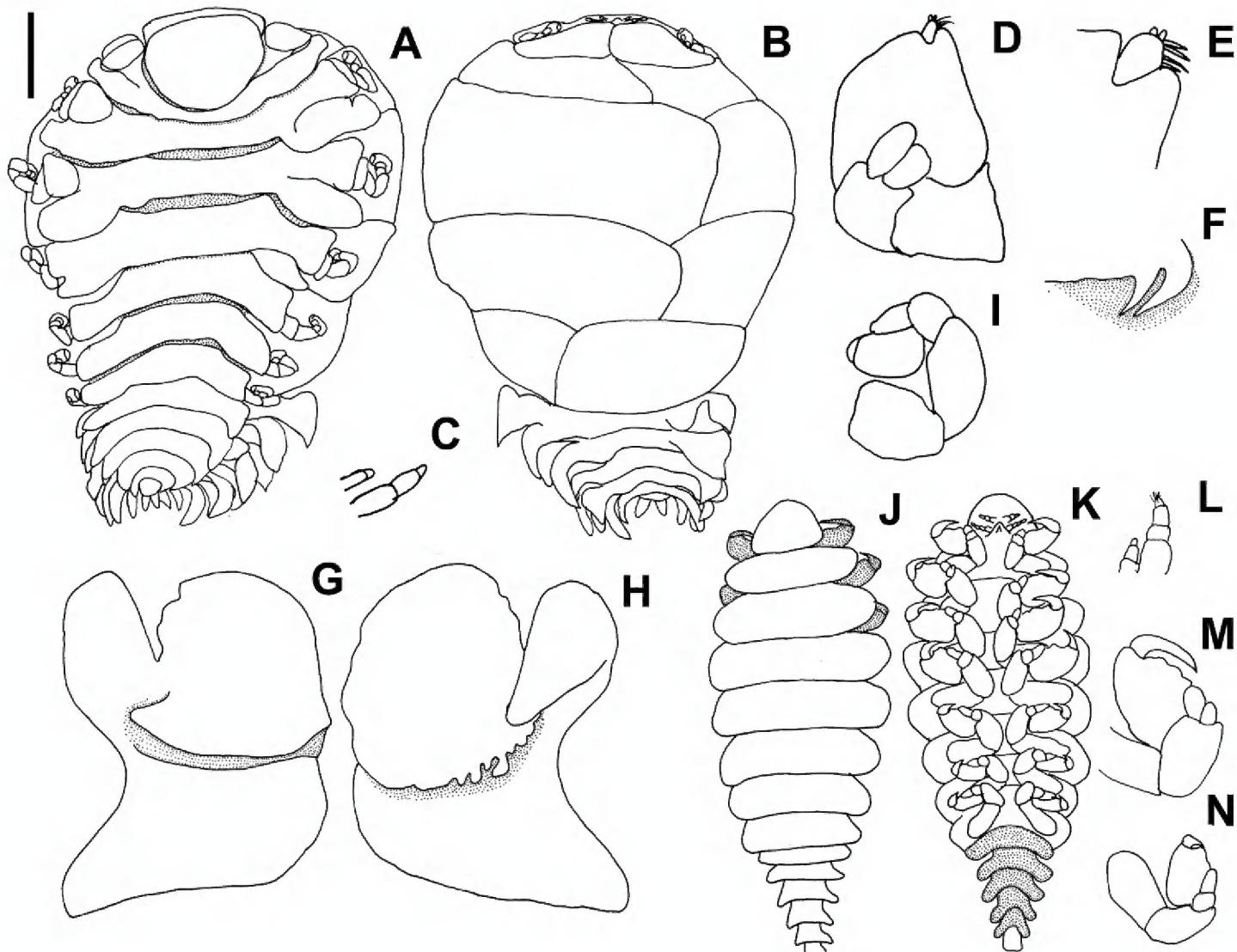
Pleon of 6 distinct pleomeres, first three produced into small lateral plates and bearing biramous pleopods; fourth and fifth pleomeres lacking lateral plates. Terminal pleomere greatly reduced and deeply embedded in fifth, bearing uniramous uropoda. All pleopodal rami produced into tapering points and progressively smaller posteriorly, extending to sides of pleon and leaving ventral surface of pleon uncovered.

**Description of allotype male**

Body outline suboval. Length 2.52 mm, maximal width across third pereomere, 1.05 mm, head length 0.30 mm, head width 0.42 mm, first pleomere width 0.50 mm, fifth width 0.20 mm. All segments distinct (Fig. 1J, K).

Head semicircular, broader than long, much narrower than first pereomere, distinctly separated from first pereomere and not at all embedded into it (Fig. 1J). Eyes absent. Antennae visible only ventrally, not extending to margins of head, of 3 and 4 articles respectively; second antenna with sparse short setae on terminal article (Fig. 1L).

Pereon smoothly rounded, slightly broadest across third pereomere. No midventral tubercles. All pereopods with all articles distinct. Pereopod 1 somewhat smaller than pereopods 2–4, those 3 pairs largest and all of about same size; pereopods 5–7 progressively smaller (Fig. 1M, N). Pereopods 1–4 bearing sharp extended dactyli, dactyli of pereopods 5–7 much reduced.



**Figure 1.** *Paguristione uniropodus* sp. n. **A–I** holotype female **J–N** allotype male. **A** Dorsal view **B** Ventral view **C** Left antennae **D** Right maxilliped, external view **E** Palp of right maxilliped **F** Left side of barbula **G** Right oostegite 1, external view **H** Right oostegite 1, internal view **I** Pereopod 4 **J** Dorsal view **K** Ventral view **L** Left antennae **M** Pereopod 2 **N** Pereopod 7. Scale: 1.00 mm (**A, B**); 0.36 mm (**D**); 0.17 mm (**C, E**); 0.50 mm (**F–I**); 0.47 mm (**J, K**); 0.23 mm (**L–M**).

Pleon elongate, extending far posteriorly, of 6 distinct pleomeres deeply separated laterally, each markedly narrower than that before it; pleomere 1 abruptly narrower than last pereomere, it and pleomere 2 much shorter than pleomeres 2–6; every pleomere broadest across posterior edge. Pleopods and uropods completely absent, not even indicated by scars.

**Etymology.** Latin noun *uniropodus*, referring to the uniramous uropoda of the female, used in apposition.

**Remarks.** The new genus differs from other closely similar hermit-crab-infesting genera *Pseudione*, *Pagurion* and *Parapagurion* thus: female with only rudimentary pleonal lateral plates (only first three pleomeres with small lateral plates) and uniramous uropoda, male with head and pleon abruptly narrower than contiguous pereomeres, first pereopod smaller than pereopods 2–4 and pleopodal appendages completely lacking. Females of *Pseudione* have distinct pleonal lateral plates on pleomeres 1–5; its males have pleopods, and their heads and pleons are smoothly narrower than the pereon. Females of *Pagurion* have distinct lamellar pleopodal appendages on all pleomeres

1–6 and biramous uropoda; its males have equally width pereopods and uniramous pleopods. Females of *Parapagurion* are nearly symmetrical and bear well-developed lateral plates on pleomeres 1–5 and uniramous uropods; the first pereopods of the males are never smaller than the second ones.

## Acknowledgments

This work was supported by the National Natural Science Foundation of China [No. 31471970]. We are indebted to Prof. Yulin Liao of IOCAS for making the collections.

## References

An J (2006) Study on the Taxonomy and Zoogeography of the Family Bopyridae (Crustacea: Isopoda) in the China Seas. Ph.D. Thesis, Institute of Oceanology of Chinese Academy of Sciences, 225 pp.

An J, Li X, Markham JC (2013) Three isopod parasites (Bopyridae: Pseudioninae), including two new species, of hermit crabs from the South China Sea. The Raffles Bulletin of Zoology 61(2): 561–569.

An J, Markham JC, Yu H (2010) Description of two new species and a new genus of bopyrid isopod parasites (Bopyridae: Pseudioninae) of hermit crabs from China. Journal of Natural History 44(33–34): 2065–2073. doi: 10.1080/00222933.2010.488753

An J, Williams JD, Yu H (2011) Three abdominal parasitic isopods (Isopoda: Epicaridea: Bopyridae: Athelginae) on hermit crabs from China and Hong Kong. Journal of Natural History 45(47–48): 2901–2913. doi: 10.1080/00222933.2011.621037

Babić K (1912) Über einen *Athelges* von Pelagosa. Zoologischer Anzeiger, Leipzig 40: 176–178.

Bourdon R, Boyko CB (2005) Redescription of *Bopyrophryxus branchiabdominalis* Codreanu, 1965. (Crustacea: Isopoda: Bopyridae) with a reappraisal of the subfamily Bopyrophryxinae Codreanu, 1965. Proceedings of the Biological Society of Washington 118(1): 108–116. doi: 10.2988/0006-324X(2005)118[108:ROBBCC]2.0.CO;2

Bourdon R (1968) Les Bopyridae des mers Européennes. Mémoires du Muséum National d’Histoire Naturelle de Paris, Nouvel Série (A) 50(2): 77–424.

Bourdon R (1979) Campagne de la Calypso au large des côtes Atlantiques de l’Amérique du Sud (1961–1962) I. 32. Crustacés Isopodes: Bopyridae parasites de Pagures. Résultats scientifiques des Campagnes de la Calypso 9: 139–144.

Boyko CB, Williams JD (2001) A review of *Pseudionella* Shiino, 1949 (Crustacea: Isopoda: Bopyridae), with the description of a new species parasitic on *Calcinus* hermit crabs from Easter Island. Proceedings of the Biological Society of Washington 114(3): 649–659. doi: 10.1651/C-2398

Boyko CB, Williams JD (2003) A revision of *Anathelges* and *Stegophryxus* (Isopoda: Bopyridae: Athelginae) with description of two new genera and one new species. Journal of Crustacean Biology 23(4): 795–813.

Boyko CB, Williams JD (2004) New records of marine isopods (Crustacea: Peracarida) from the Bahamas, with descriptions of two new species of epicarideans. *Bulletin of Marine Science* 74(2): 353–383.

Boyko CB, Williams JD (2010) A new genus and species of primitive bopyrid (Isopoda, Bopyridae) parasitizing hermit crabs (Anomura) from deep waters in the eastern Atlantic and Japan. In: Fransen C, de Grave S, Ng P (Eds) *Studies on Malacostraca: Lipke Bijdeley Holthuis Memorial Volume*. *Crustaceana Monographs* 14: 145–157.

Boyko CB (2004) The Bopyridae (Crustacea: Isopoda) of Taiwan. *Zoological Studies* 43: 677–703.

Brunenmeister SL (1980) Comparative studies of hermit crab communities. A dissertation presented to the Faculty of the Department of Biology, University of Houston, in partial fulfillment of the requirements for the degree Doctor of Philosophy, 217 pp.

Brusca RC (1980) Common intertidal invertebrates of the Gulf of California. Revised and expanded. The University of Arizona Press, Tucson, Arizona, 513.

Codreanu R, Codreanu M (1963) Sur plusieurs bopyriens parasites branchiaux des anomoures de la Mer Noire, de la Méditerranée et du Viet-Nam. *Rapports et Procès verbaux des réunions de la Commission internationale pour l'Exploration scientifique de la mer Méditerranée* 17(2): 283–285.

Haig J, Ball EE (1988) Hermit crabs from north Australian and eastern Indonesian waters (Crustacea: Anomura: Paguroidea) collected during the 1975 *Alpha Helix* Expedition. *Records of the Australian Museum* 40: 151–196. doi: 10.3853/j.0067-1975.40.1988.153

Ishii S (1914) On a new epicaridean isopod (*Athelges takanoshimensis* sp. nov.) from *Eupagurus samuelis* Stimpson. *Annotationes Zoologicae Japonenses* 8: 519–530.

Kazmi QB, Markham JC (1999) *Allathelges pakistanensis*, new genus, new species, a bopyrid isopod from Karachi, with a review of the Athelginae recorded from the Indian Ocean. *Journal of Crustacean Biology* 19(4): 879–885. doi: 10.2307/1549306

Kim HS, Kwon DH (1988) Bopyrid isopods parasitic on decapod crustaceans in Korea. *The Korean Journal of Systematic Zoology. Special Issue No. 2*: 199–221.

Markham JC (1978) Bopyrid isopods parasitizing hermit crabs in the northwestern Atlantic Ocean. *Bulletin of Marine Science* 28(1): 102–117.

Markham JC (1982) Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and southern China. Volume 1. In: Morton BS, Tseng CK (Eds) *Proceedings of the First International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China*. Hong Kong University Press, Hong Kong, 325–391.

Markham JC (1985a) A new species of *Asymmetrione* (Isopoda: Bopyridae) infesting the hermit crab *Isocheles pilosus* (Holmes) in southern California. *Bulletin of the Southern California Academy of Sciences* 84: 104–108.

Markham JC (1985b) Additions to the bopyrid fauna of Thailand. *Zoologische Verhandelingen* 224: 1–63.

Markham JC (1990) Further notes on the Isopoda Bopyridae of Hong Kong. Volume 2. In: Morton BS (Ed.) *Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and southern China*, Hong Kong, 1986. Hong Kong University Press, Hong Kong, 555–568.

Markham JC (1992) Second list of additions to the Isopoda Bopyridae of Hong Kong. In: Morton BS (Ed.) The marine flora and fauna of Hong Kong and southern China 3. Volume 1: Introduction, taxonomy and ecology. Proceedings of the Fourth International Marine Biological workshop: The Marine Flora and Fauna of Hong Kong and Southern China, 11–29 April 1989. Hong Kong University Press, Hong Kong, 277–302.

McDermott JJ (1998) Prevalence of two epicaridean isopods (Bopyridae and Entoniscidae) associated with the hermit crab *Pagurus longicarpus* Say, 1817 (Anomura) from the New Jersey coast (U. S. A.). *Journal of Parasitology* 84(5): 1042–1045. doi: 10.2307/3284642

McDermott JJ, Williams JD, Boyko CB (2010) The unwanted guests of hermits: A global review of the diversity and natural history of hermit crab parasites. *Journal of Experimental Marine Biology and Ecology* 394: 2–44. doi: 10.1016/j.jembe.2010.06.022

Nagasawa K, Lützen J, Kado R (1996) Parasitic Cirripedia (Rhizocephala) and Isopoda from brachyuran and anomuran crabs of the Pacific coast of northern Honshu, Japan. *Bulletin of the Biogeographical Society of Japan* 51(2): 1–6.

Nierstrasz HF, Brender à Brandis GA (1923) Die Isopoden der Siboga-Expedition. II. Isopoda Genuina. I. Epicaridea. *Siboga Expeditie Monographie* 32b: 57–121.

Nierstrasz HF, Brender à Brandis GA (1931) Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16. 57. Epicaridea 2. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjøbenhavn* 91: 147–225.

Nierstrasz HF, Brender à Brandis GA (1932) Alte und neue Epicaridea. *Zoologischer Anzeiger* 101: 90–100.

Page RDM (1985) Review of the New Zealand Bopyridae (Crustacea: Isopoda: Epicaridea). *New Zealand Journal of Zoology* 12: 185–212. doi: 10.1080/03014223.1985.10428279

Pardo LM, Boyko CB, Matelatto FL (2009) Description of a new species of *Asymmetrione* (Isopoda: Bopyridae: Pseudioninae) infesting the hermit crab *Paguristes tomentosus* (Anomura: Diogenidae) from Peru, with a key to species and a review of southeastern Pacific bopyrids. *Journal of Natural History* 43(33–34): 2041–2055. doi: 10.1080/00222930903094639

Pike RB (1953) The bopyrid parasites of the Anomura from British and Irish waters. *Journal of the Linnean Society of London (Zoology)* 42(285): 219–237, pls. 44–48. doi: 10.1111/j.1096-3642.1953.tb02540.x

Pike RB (1961) A new bopyrid parasite collected by the Chatham Islands 1954 Expedition. *New Zealand Department of Scientific Industries Research Bulletin* 139, *Biological Results of the Chatham Islands 1954 Expedition Part 5*: 221–223.

Poupin J, Lemaitre R (2003) Hermit crabs of the genus *Calcinus* Dana, 1851 (Crustacea: Anomura: Diogenidae) from the Austral Islands, French Polynesia, with description of a new species. *Zootaxa* 391: 1–20.

Saito N, Itani G, Nunomura N (2000) A preliminary check-list of isopod crustaceans in Japan. *Bulletin of the Toyama Science Museum* 23: 11–107.

Shiino SM (1933) Bopyrids from Tanabe Bay. *Memoirs of the College of Science, Kyoto Imperial University (B)* 8(3, Article 8): 249–300.

Shiino SM (1934) Bopyrids from Tanabe Bay II. *Memoirs of the College of Science, Kyoto University (B)* 9(4, Article 7): 257–287.

Shiino SM (1936) Bopyrids from Tanabe Bay, III. Memoirs of the College of Science, Kyoto Imperial University (B) 11(3): 157–174.

Shiino SM (1937) Bopyrids from Tanabe Bay, IV. Memoirs of the College of Science, Kyoto Imperial University (B) 12(3, Article 18): 479–493.

Shiino SM (1949) On two new genera of Bopyridae found in Japan. Bulletin of the Biogeographical Society of Japan 14(11): 57–63.

Shiino SM (1950) Notes on some new bopyrids from Japan. Mie Medical Journal 1(2): 151–167.

Shiino SM (1958) Note on the bopyrid fauna of Japan. Report. Faculty of Fisheries. Prefectural University of Mie 3: 27–73.

Shyamasundari K, Hanumantha-Rao K, Kumari CJ, Mary A (1993) A new bopyrid isopod *Athelges neotenuicaudis* (Crustacea: Isopoda: Epicaridea) parasitic on *Pagurus kulkarnii* from Visakhapatnam Coast, India. Boletin Chileno de Parasitología 48(3-4): 60–63.

Wei C (1991) Isopoda. In: Wei C (Ed.) Fauna of Zhejiang, Crustacea. Zhejiang Science and Technology Publishing House, Zhejiang, China, 94–147.

Williams JD, Boyko CB (1999) A new species of *Pseudostegias* Shiino, 1933 (Crustacea: Isopoda: Bopyridae: Athelginae) parasitic on hermit crabs from Bali. Proceedings of the Biological Society of Washington 112(4): 714–721.

Williams JD, McDermott JJ (2004) Hermit crab biocoenosis: a worldwide review of the diversity and natural history of hermit crab associates. Journal of Experimental Marine Biology and Ecology 305: 1–128. doi: 10.1016/j.jembe.2004.02.020

Williams JD, Schuerlein LM (2005) Two new species of branchial parasitic isopods (Crustacea: Isopoda: Bopyridae: Pseudioninae) from hermit crabs collected in Singapore. Proceedings of the Biological Society of Washington 118(1): 96–107. doi: 10.2988/0006-324X(2005)118[96:TNSOBP]2.0.CO;2

Williams JD, Gallardo A, Murphy AE (2011) Crustacean parasites associated with hermit crabs from the western Mediterranean Sea, with first documentation of egg predation by the burrowing barnacle *Trypetesa lampas* (Cirripedia: Acrothoracica: Trypetesidae). Integrative Zoology 6: 13–27. doi: 10.1111/j.1749-4877.2010.00226.x